

CLAIMS

What is claimed is:

1. A hydrogen-oxygen fuel cell, comprising:
an ionically conducting media disposed between an anode and a cathode;
a hydrogen distribution system in communication with the anode;
an oxygen distribution system in communication with the cathode; and
a hydrogen-oxygen recombination catalyst disposed in the hydrogen distribution system, the oxygen distribution system, or a combination thereof.
2. The fuel cell of claim 1, wherein the ionically conducting media is a proton exchange membrane.
3. The fuel cell of claim 1, wherein the ionically conducting media is a perfluorinated sulphonic acid polymer.
4. The fuel cell of claim 1, wherein the recombination catalyst comprises components selected from platinum, palladium, gold, tin, and combinations thereof.
5. The fuel cell of claim 1, wherein the recombination catalyst comprises platinum.
6. The fuel cell of claim 1, wherein the recombination catalyst is mixed with a compound that bonds the recombination catalyst to one or more surfaces of the hydrogen distribution system, one or more surfaces of the oxygen distribution system, or a combination thereof.
7. The fuel cell of claim 1, wherein the recombination catalyst is disposed on a surface within the hydrogen distribution system.

8. The fuel cell of claim 7, wherein the surface is of components selected from a flowfield, a gas diffusion layer, a current collector, a manifold, a frame, a bipolar plate, a monopolar plate, an endplate and combinations thereof.
9. The fuel cell of claim 8, wherein the recombination catalyst does not reduce electrical communication of the components.
10. The fuel cell of claim 7, wherein the recombination catalyst is disposed by mixing the recombination catalyst with a bonding agent and applying the mixture to the surface, and wherein the bonding agent bonds the recombination catalyst to the surface.
11. The fuel cell of claim 10, wherein the mixture is applied by a method selected from spreading, spraying, dipping, rolling and combinations thereof.
12. The fuel cell of claim 8, wherein the flow field is made of material selected from expanded metal mesh, metal foam, conducting polymer foam, porous conductive carbon material and combinations thereof.
13. The fuel cell of claim 12, wherein the flow field is bonded by a metal-to-metal bond with the bipolar plate, the monopolar plate, the endplate or the current collector.
14. The fuel cell of claim 13, wherein the metal-to-metal bond is by a method selected from brazing, welding, soldering and combinations thereof.
15. The fuel cell of claim 13, wherein the metal-to-metal bond is formed before the recombination catalyst is disposed on the surface.
16. The fuel cell of claim 12, wherein the flow field is bonded by a conductive adhesive bond with the bipolar plate, the monopolar plate, the endplate or the current collector.

17. The fuel cell of claim 16, wherein the conductive adhesive bond is formed before the recombination catalyst is disposed on the surface.

18. The fuel cell of claim 1, wherein the recombination catalyst is disposed on a surface within the oxygen distribution system.

19. The fuel cell of claim 18, wherein the surface is of components selected from a flowfield, a gas diffusion layer, a current collector, a manifold, a frame, a bipolar plate, a monopolar plate, an endplate and combinations thereof.

20. The fuel cell of claim 19, wherein disposing the recombination catalyst does not reduce electrical communication of the components.

21. The fuel cell of claim 18, wherein the recombination catalyst is disposed by mixing the recombination catalyst with a bonding agent and applying the mixture to the surface, wherein the bonding agent bonds the recombination catalyst to the surface.

22. The fuel cell of claim 21, wherein the mixture is applied by a method selected from spreading, spraying, dipping, rolling and combinations thereof.

23. The fuel cell of claim 19, wherein the flow field is made of material selected from expanded metal mesh, metal foam, conducting polymer foam, porous conductive carbon material and combinations thereof.

24. The fuel cell of claim 23, wherein the flow field is bonded by a metal-to-metal bond with the bipolar plate, the monopolar plate, the endplate or the current collector.

25. The fuel cell of claim 24, wherein the metal-to-metal bond is by a method selected from brazing, welding, soldering and combinations thereof.

26. The fuel cell of claim 24, wherein the metal-to-metal bond is formed before the recombination catalyst is disposed on the surface.
27. The fuel cell of claim 23, wherein the flow field is bonded by a conductive adhesive bond with the bipolar plate, the monopolar plate, the endplate or the current collector.
28. The fuel cell of claim 27, wherein the conductive adhesive bond is formed before the recombination catalyst is disposed on the surface
29. The fuel cell of claim 1, wherein the oxygen distribution system is an air distribution system.
30. The fuel cell of claim 1, wherein the hydrogen and oxygen distribution systems operate at pressures less than one atmosphere.
31. The fuel cell of claim 1, wherein the hydrogen and oxygen distribution systems are operated at pressures greater than one atmosphere.
32. The fuel cell of claim 1, wherein the hydrogen and oxygen distribution systems are operated at different pressures.
33. In a hydrogen-oxygen fuel cell having an anodic electrocatalyst, a cathodic electrocatalyst, an ionically conducting membrane disposed between the anodic electrocatalyst and the cathodic electrocatalyst, anode flow field for distributing hydrogen to the anodic electrocatalyst, and a cathode flow field for distributing oxygen to the cathodic electrocatalyst, the improvement comprising:
a hydrogen-oxygen recombination catalyst disposed on one or more of the flow fields.

34. The fuel cell of claim 33, wherein the recombination catalyst comprises components selected from platinum, palladium, gold, tin, and combinations thereof.

35. The fuel cell of claim 33, wherein the recombination catalyst comprises platinum.

36. The fuel cell of claim 33 wherein the recombination catalyst is mixed with a bonding compound that bonds the recombination catalyst to the one or more flow fields.

37. The fuel cell of claim 33, wherein the recombination catalyst mixed with a bonding component does not reduce electrical communication between the one or more flow fields and the electrocatalysts.

38. The fuel cell of claim 33, wherein the one or more flow fields are made of material selected from expanded metal mesh, metal foam, conducting polymer foam, porous conductive carbon material and combinations thereof.

39. The fuel cell of claim 38, further comprising:

an anode endplate in electrical communication with the anode flow field;
a cathode endplate in electrical communication with the cathode flowfield.

40. The fuel cell of claim 39, wherein the electrical communication is through metal-to-metal bonding or through conductive adhesive bonds, and wherein the bonding is by methods selected from brazing, soldering, welding and conductive adhesives.

41. The fuel cell of claim 40, wherein the bond is formed before the recombination catalyst is bonded to one or more of the endplates.

42. The fuel cell of claim 41, wherein the recombination catalyst is bonded to one or more of the endplates with PTFE.

43. A hydrogen-oxygen fuel cell, comprising:
 - an ionically conducting membrane disposed between an anodic electrocatalyst and a cathodic electrocatalyst;
 - an anode chamber adjacent the anodic electrocatalyst for distributing hydrogen to the anodic electrocatalyst;
 - a cathode chamber adjacent the cathodic electrocatalyst for distributing oxygen to the cathodic electrocatalyst; and
 - a hydrogen-oxygen recombination catalyst disposed in one or more of the chambers.
44. The fuel cell of claim 43, wherein the recombination catalyst comprises components selected from platinum, palladium, gold, tin and combinations thereof.
45. The fuel cell of claim 43, wherein the recombination catalyst comprises platinum.
46. The fuel cell of claim 43, wherein the recombination catalyst is mixed with a bonding compound that bonds the recombination catalyst to a surface in the one or more chambers.
47. The fuel cell of claim 43, further comprising an anode flow field disposed in the anode chamber, wherein the recombination catalyst is disposed on the anode flow field.
48. The fuel cell of claim 47, wherein the recombination catalyst is mixed with a bonding compound that bonds the recombination catalyst to a surface in the anode flow field.
49. The fuel cell of claim 47, wherein the anode flow field is made of material selected from expanded metal mesh, metal foam, conducting polymer foam, porous conductive carbon material and combinations thereof.
50. The fuel cell of claim 49, further comprising a bipolar separator plate forming a wall of the anode chamber, wherein the recombination catalyst is disposed on the bipolar separator plate.

51. The fuel cell of claim 50, wherein the anode flow field is bonded to the bipolar separator plate by a method selected from brazing, soldering, welding and conductive adhesives.
52. The fuel cell of claim 51, wherein the recombination catalyst mixed with a bonding compound does not reduce electrical communication between the bipolar plate and the anode flow field.
53. The fuel cell of claim 51, wherein the recombination catalyst mixed with a bonding compound does not reduce electrical communication between the anodic electrocatalyst and the anode flow field
54. The fuel cell of claim 43, further comprising a cathode flow field disposed in the cathode chamber, wherein the recombination catalyst is disposed on the cathode flow field.
55. The fuel cell of claim 54, wherein the recombination catalyst is mixed with a bonding compound that bonds the recombination catalyst to a surface in the cathode flow field.
56. The fuel cell of claim 54, wherein the cathode flow field is made of material selected from expanded metal mesh, metal foam, conducting polymer foam, porous conductive carbon material and combinations thereof.
57. The fuel cell of claim 56, further comprising a bipolar separator plate forming a wall of the cathode chamber, wherein the recombination catalyst is disposed on the bipolar separator plate.
58. The fuel cell of claim 57, wherein the cathode flow field is bonded to the bipolar separator plate by a method selected from brazing, soldering, welding and conductive adhesives.

59. The fuel cell of claim 58, wherein the recombination catalyst mixed with a bonding compound does not reduce electrical communication between the bipolar plate and the cathode flow field.

60. The fuel cell of claim 58, wherein the recombination catalyst mixed with a bonding compound does not reduce electrical communication between the cathodic electrocatalyst and the cathode flow field

61. The fuel cell of claim 43, further comprising a gas diffusion electrode disposed in the anode chamber, wherein the recombination catalyst is disposed on the gas diffusion electrode.

62. The fuel cell of claim 61, further comprising a bipolar plate, wherein the recombination catalyst does not reduce electrical communication between the anodic electrocatalyst and the bipolar plate.

63. The fuel cell of claim 43, further comprising a gas diffusion electrode disposed in the cathode chamber, wherein the recombination catalyst is disposed on the gas diffusion electrode.

64. The fuel cell of claim 63, further comprising a bipolar plate, wherein the recombination catalyst does not reduce electrical communication between the cathodic electrocatalyst and the bipolar plate

65. The fuel cell of claim 43, further comprising:

anode fluid manifolds selected from an inlet anode fluid manifold, an outlet anode fluid manifold and combinations thereof, wherein the anode chamber manifolds are in fluid communication with the anode chamber.

66. The fuel cell of claim 65, wherein the recombination catalyst is disposed on an interior surface of one or more of the anode fluid manifolds.

67. The fuel cell of claim 43, further comprising;

cathode fluid manifolds selected from an inlet cathode fluid manifold, an outlet cathode fluid manifold and combinations thereof, wherein the cathode fluid manifolds are in fluid communication with the cathode chamber.

68. The fuel cell of claim 67, wherein the recombination catalyst is disposed on an interior surface of one or more of the cathode fluid manifolds.